Space Weather Technical Forecast

Issued on Thursday, 11 April 2024 at 13:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of Moderate activity from 12 Apr. Slight chance of G1 Minor geomagnetic storms on 13 and 14 Apr.

Solar Activity: Solar activity is Low, with a peak flare of C3.5 at 11/1110UTC from AR3636 in the northeast quadrant. AR3628 and AR3633 appear to be the most stable regions, but are also the largest on the disc. AR3634 has developed in complexity, but has also produced limited activity. AR3635 in the northeast appears to be increasing in activity despite remaining relatively benign.

Two filament eruptions were observed leaving the north-central disc early on 11 Apr with the risk of an Earth-directed component. Imagery is still limited, but analysis will be undertaken when possible.

Solar Wind / Geomagnetic Activity: Solar wind speeds, as observed at L1 have averaged around 400-500km/s as the Earth remains under the influence of a high speed stream from coronal hole 22. Density has been around average. The total magnetic field strength was weak throughout with the north-south component also varying weakly between -5nT and +5nT. Phi angle was predominantly positive (towards the Sun) but with brief incursions into the negative sector. Geomagnetic activity was Quiet to Unsettled.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES18 was at background levels.

High energy electron flux (greater than 2MeV) observed at GOES16 was at background to moderate levels. The associated 24-hour fluence remained well below the Active (1e8 integrated flux) threshold, on an increasing, then steady trend, with a value of 1.07e7 integrated pfu recorded at 11/0000UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to remain mainly Low, but with an increasing chance of Moderate activity later in the period as significant returning regions rotate onto the visible disc.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently forecast, with two filament eruptions from north-centre disc awaiting analysis. Solar wind speeds are expected to ease later on 11 and into 12 Apr as a high speed stream from coronal hole 22 wanes. The high speed stream from coronal hole 24 is then expected to connect with Earth through 13 and 14 Apr, with speeds of 450-500km/s forecast. Geomagnetic activity is forecast to be mainly Quiet to Unsettled on 11 and 12 Apr. Unsettled to Active intervals are then possible on 13 or 14 Apr as the next high speed stream connects. Depending in the strength of the connection, there is a risk of G1/Minor Storms.

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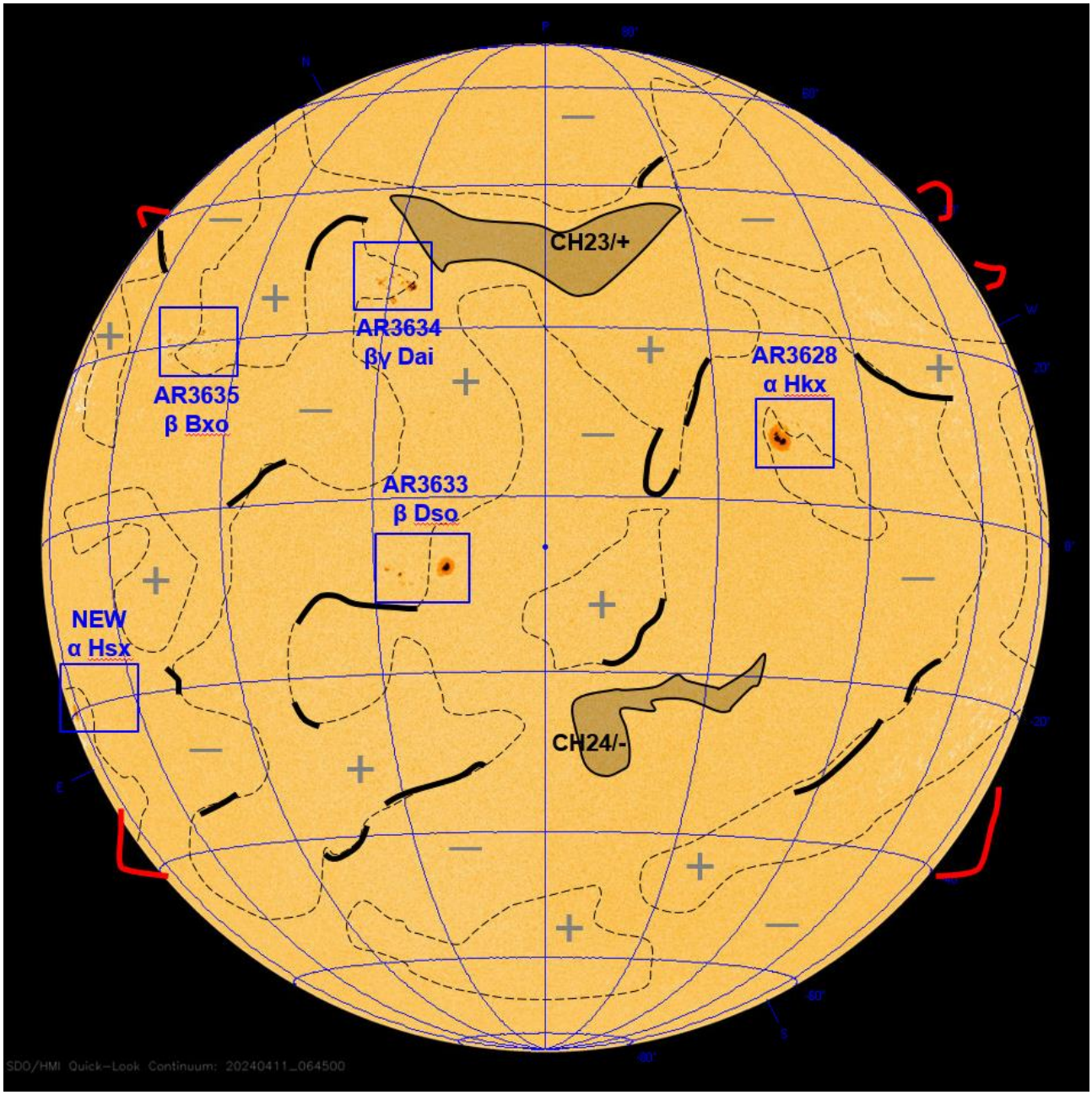
Energetic Particles / Solar Radiation: High energy proton flux as observed by GOES-18 is expected to persist at background levels. High energy electron flux at GOES16 is expected to continue at background to moderate levels. The associated 24-hour electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold.

Figure 1. Solar Analysis Valid 11/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx – Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Two filament eruptions were observed emanating from the north-centre disc early on 11 Apr. The most significant eruption was at 11/0530UTC, the western of the two eruptions. Coronagraph imagery is still filtering through, so a full analysis has not been undertaken, but there is the risk of an Earth-directed component.

Otherwise the Earth is under the influence of the high speed stream from coronal hole 22 with this expected to wane later on 11 Apr and through 12 Apr. The high speed stream from coronal hole 24 is then forecast to connect with Earth through 13 and 14 Apr. On the last rotation, this recurrent feature produced a solar wind speed of around 400-450km/s. As the coronal hole is slightly larger on this rotation, speeds may reach 450-500km/s. Enlil modelling is predicting a current high speed stream of close to 600km/s, but as the model is forecasting that this should already be affecting the Earth, Enlil is considered to be erroneous.

Geomagnetic activity is forecast to be mainly Quiet to Unsettled through 11 and 12 Apr. Activity is likely to become mainly Unsettled with Active intervals on either 13 or 14 Apr, due to the next high speed stream onset, with a slight chance of G1/Minor Storms following the onset of the high speed stream.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: SDO imagery with region of filament eruptions highlighted.

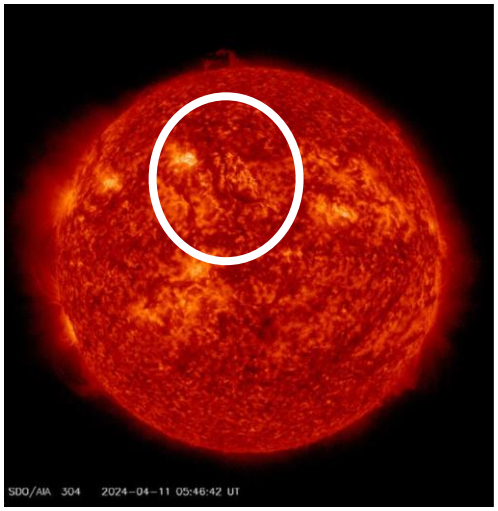

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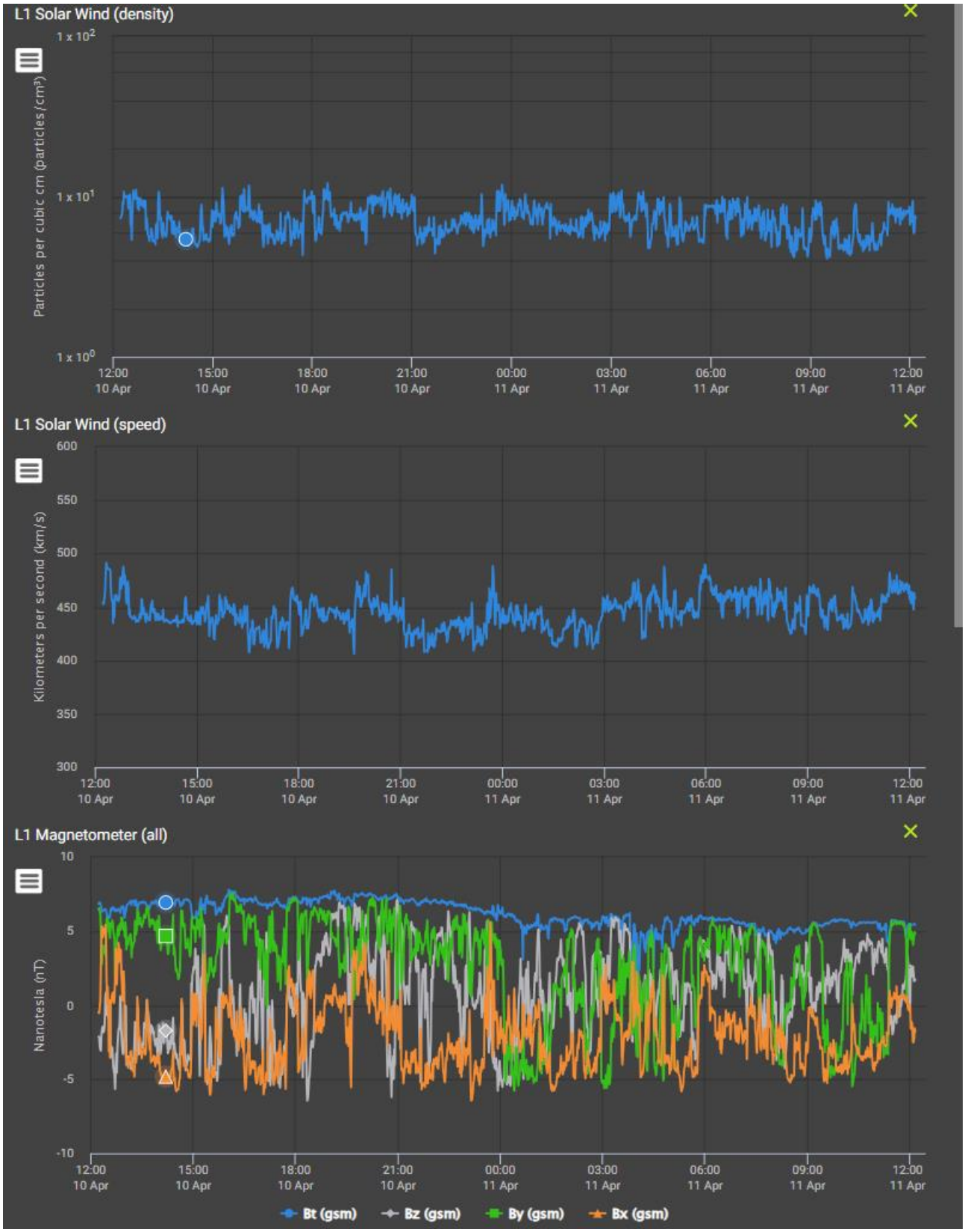
Figure 3: SDO imagery with region of filament eruptions highlighted.



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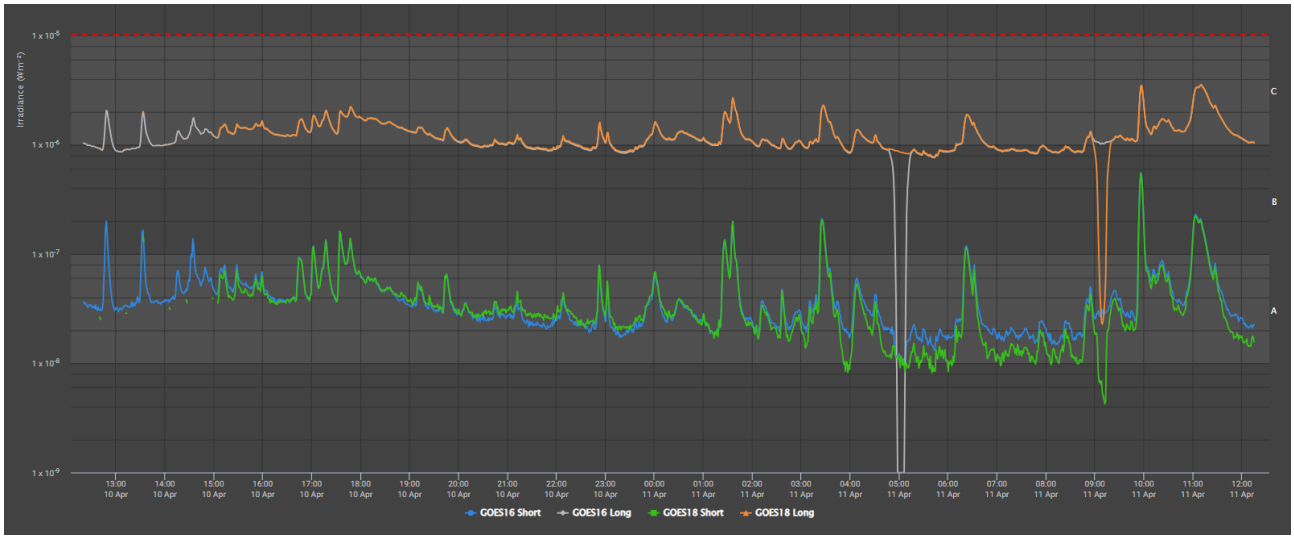
Radio Blackouts - X-Ray Flares:
There are five sunspot regions on the visible disc, with four of these numbered. The largest region, AR3628 appears relatively stable, as does AR3633 in the southeast. AR3634 has developed in complexity, but still appears small, with AR3635 also benign. A further region has rotated onto the southeast limb and will be monitored for any further developments. A number of returning regions are likely to rotate onto the visible disc from the eastern limb through the forecast period, with evidence of their existence on the far side determined through visible looping. The most significant returning region is ex-AR3615, which is due to rotate onto the eastern limb either on 12 or 13 Apr, with its continued persistence observed from Mars Perseverance imagery. An increase in flare activity is therefore forecast for this region, assuming a similar potency as the last rotation.

Solar activity is forecast to be mainly Low with an increasing risk of Moderate activity as the period persists.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	20	30	30
Very Active	R3 to R5 X Class	No	1	1	5	5

Figure 4: GOES 16 X-ray flux



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux as observed by GOES18 is at background levels. Solar radiation storms are considered a background risk during the period given the lack of appropriately active sunspot regions moving into in the western portion of the disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux is currently oscillating between background and moderate on diurnal variations. This pattern is expected to continue through 11 and 12 Apr in the presence of a weak high speed stream. The next forecast high speed stream onset on 13 Apr may lead to a slight decrease followed by increased diurnal peaks, perhaps reaching the high (1e3pfu) threshold toward the end of the period.

Electron fluence values are at background levels and are likely to follow a rising trend following the onset of the next high speed stream, with an increasing chance of reaching the Active (1e8 integrated pfu) threshold by the end of the period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	5	5	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

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